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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/772,051	01/29/2001	Kazuhisa Shida	0941.65172	8505

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EXAMINER	
UHLIR, NIKOLAS J	
ART UNIT	**PAPER NUMBER**
1773	

DATE MAILED: 06/07/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/772,051	SHIDA ET AL.
	Examiner	Art Unit
	Nikolas J. Uhlir	1773

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 24 May 2004.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-3,5-10,12,13,15 and 16 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-3, 5-10, 12-13, 15-16 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. This office action is in response to the amendment/request for continued examination (rce) dated 05/24/2004. The applicant's amendment/arguments are deemed sufficient to overcome the previous objections to claims 17 and 18. Accordingly, these objections are withdrawn. Further, the applicant's amendment is sufficient to overcome the prior rejection of claims 1-2, 8-9, and 16 as anticipated under 35 U.S.C 102(a), (e). Accordingly, these rejections are withdrawn. However, applicant's amendment/arguments are not considered to be persuasive in overcoming the cited prior art.

Claim Rejections - 35 USC § 103

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

3. Claims 1-3, 5, 8-10, 12, and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsuda (US6623873) in view of Malhotra (US6303217) and Bian (US5789056).

4. Claim 1 requires a magnetic recording medium comprising a substrate; and a magnetic layer, including a CoCr-based alloy and non-magnetic elements other than Cr, and having a multi-layer structure and disposed above said substrate, said multilayer structure having a first magnetic layer disposed above said substrate and at least one second magnetic layer disposed directly on said first magnetic layer on an opposite side from said substrate; a first underlayer including a Cr-based alloy and disposed on said substrate; and a second underlayer including a Cr-based alloy and disposed between

said first underlayer and said first magnetic layer, said first magnetic layer having a Cr-content larger than that of the second magnetic layer, said first magnetic layer having a larger sum total content of non-magnetic elements other than Cr and which have a larger atomic radius than Co compared to said second magnetic layer, said second underlayer having a larger sum total content of elements other than Cr than said first underlayer.

5. With respect to these limitations, Matsuda et al (Matsuda) teaches a specific example which anticipates all of the limitations of claim 1. Specifically, Matsuda teaches a magnetic recording medium comprising a substrate, a CrTi underlayer, a $CoCr_{21}Pt_{12}$ (subscripts are atomic %) magnetic layer on the CrTi underlayer, and a $CoCr_{19}Pt_8Ta_3$ magnetic layer formed directly on the $CoCr_{21}Pt_{12}$ layer (column 10, embodiment 2, lines 53-67). Thus, all of the magnetic layer requirements of claim 1 are clearly anticipated by Matsuda.

6. However, Matsuda does not teach the dual underlayer required by claim 1.

7. With respect to this deficiency, Malhotra et al. (Malhotra) teaches a magnetic recording media that comprises a substrate, a first underlayer, a second underlayer, and a magnetic recording layer deposed on the second underlayer. The first underlayer can comprise a Cr alloy that comprises between 5-30 at% of Mo, Ta, V, W, Ti etc... The second underlayer can comprise a Cr alloy that contains 5-30 at% of Mo, V, Ta, Ti, etc...or a ternary alloy of Cr that contains 5-30 at% of two elements selected from Mo, Ta, V, Ti, etc... (Column 1, line 55-column 2, line 18). The magnetic layer is a cobalt based alloy, including CoCr, CoCrTa, CoCrPt, CoCrNiPtB, and other alloys containing

at least 50% Co (column 4, line 19-30). This underlayer structure results in a magnetic recording media that exhibits improved signal amplitude (column 1, lines 50-53).

8. Therefore it would have been obvious to one of ordinary skill in the art to utilize a dual underlayer structure comprising two layers of CrTi as taught by Malhotra as the underlayer utilized in Matsuda, in light of the teaching Malhotra that utilizing such an underlayer structure results in a media that exhibits improved signal amplitude.

9. Matsuda as modified by Malhotra fails to teach that a second underlayer that contains larger amounts of elements other than Cr then the 1st underlayer.

10. However, Bian et al. teaches a magnetic recording media that comprises a substrate, a seed layer on the substrate, an underlayer on the seedlayer, and a magnetic recording layer deposited on the underlayer. The seed layer is an alloy of Cr and Ti, wherein the amount of Ti is >5at% (column 2, lines 39-63). The underlayer is comprised of a chromium alloy such as CrV_x, where x is 0-50 at% and $CrTi_y$, where y is 0-30 at% (column 3, line 66-column 4, line 2). The magnetic layer is manufactured from materials including CoCrPt and CoCrPtTa (column 4, lines 8-15). In a specific example, Bian teaches a magnetic recording medium wherein a $Cr_{93}Ti_7$ seedlayer is formed on a substrate, a $Cr_{90}Ti_{10}$ underlayer is formed on the $Cr_{93}Ti_7$ seedlayer, and a magnetic layer is formed on the underlayer. This medium exhibits improved signal to noise ratio over that of a magnetic recording medium utilizing a pure Cr seedlayer (column 3, lines 20-60).

11. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize a$Cr_{93}Ti_7$ alloy and the $Cr_{90}Ti_{10}$ alloy taught by Bian as

the lower and upper underlayer (respectfully) of the dual underlayer structure taught by Matsuda as modified by Malhotra.

12. One would have been motivated to make this modification in view of the fact that Matsuda as modified by Malhotra is particularly concerned with obtaining a recording medium having improved signal amplitude and the fact that the specific example of Bian cited above shows improved signal to noise ratio.

13. Thus, all of the limitations of claim 1 are met.

14. Claim 2 is met as set forth above for claim 1.

15. Claim 3 requires the first and second magnetic layers to include 8-15 atomic % PT and 1-6 atomic % B. Matsuda teaches the formation of a magnetic recording medium having a first magnetic layer comprising of a $CoCr_{22}Pt_{12}$ alloy, and a second magnetic layer of $CoCr_{21}Pt_{12}B_4$ alloy formed directly on the first magnetic layer (column 14, embodiment 5). However, Matsuda teaches that the first magnetic layer can suitably be formed from a CoCrPtTa alloy that additionally contains B, wherein the alloy contains 20-24 atomic % Cr, 8-20 atomic % Pt, ≤1.5 atomic % Ta, and 1-3 atomic % B (column 5, lines 1-20 and column 4, lines 52-62).

16. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute a $CoCr_{24}Pt_{20}Ta_{1.5}B_3$ alloy for the $CoCr_{22}Pt_{12}$ 1st magnetic layer taught in embodiment 2 of Matsuda, as Matsuda clearly teaches that 24 atomic %Cr, 20 atomic % Pt, 1.5 atomic % Ta, and 3 atomic % B are suitable amounts of these elements for use in the first magnetic layer, and thus Matsuda recognizes the

equivalence of a $CoCr_{24}Pt_{20}Ta_{1.5}B_3$ alloy and a $CoCr_{22}Pt_{12}$ alloy as suitable alloys for use as the first magnetic layer.

17. The applicant is respectfully reminded that substitution of equivalents requires no express motivation. Thus, the limitations of claim 3 are met.

18. Claim 5 is met as set forth above for claim 1.

19. Claims 8-10 and 12 are met as set forth above for claim 1-3 and 5.

20. Claim 16 requires the same limitations as claim 1, and additionally requires a magnetic head. Matsuda teaches an apparatus which utilizes a magnetic head to read the media at column 6, lines 36-55. Thus, Matsuda as modified by Malhotra and Bian meets all of the limitations of claim 16.

21. Claims 6 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsuda as modified by Malhotra and Bian as applied to claims 4 and 11 above, and further in view of Bertero et al. (US6150015).

22. Matsuda as modified by Malhotra and Bian as set forth above fails to teach the limitations of claims 6 and 13, which require a Co based alloy intermediate layer between the second underlayer and the 1st magnetic layer.

23. However, Bertero et al. teaches a magnetic media the comprises a substrate, a chromium or chromium alloy underlayer on the substrate, an ultra thin nucleation layer comprising Co based alloy deposed on the underlayer, and a magnetic layer comprising a Co alloy such as CoCrPt on the nucleation layer (column 15, line 54-column 16, line 25). Magnetic media utilizing the nucleation layer exhibit drastically improved coercivity and squareness as compared to media that do not utilize the nucleation layer.

24. Therefore it would have been obvious to one with ordinary skill in the art at the time the invention was made to utilize a thin nucleation layer of a Co based alloy as described by Bertero et al. between the second underlayer and the first magnetic layer described by Matsuda as modified by Malhotra and Bian.

25. One would have been motivated to make this modification due to the teaching in Bertero et al. that magnetic media that incorporate a Co based alloy as a nucleation layer exhibit drastically improved coercivity and squareness as compared to those media that do not utilize a nucleation layer. Thus, the limitations of claims 6 and 13 are met.

26. Claims 7 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsuda as modified by Malhotra and Bian applied to claims 1 and 8 above, and further in view of Paik et al. (IEEE Transactions on Magnetics, Vol. 28, No. 5, September 1992).

27. Matsuda as modified by Malhotra and Bian as set forth above fails to teach the limitations of claims 7 and 15, which require a magnetic recording medium of claim 1 to comprise a plurality of 2nd magnetic layers, such that the 1st magnetic layer has a larger Cr content than that of the lowermost 2nd magnetic layer and contains a greater sum total of non-magnetic elements other than Cr having an atomic radius greater than Co than that of the lowest 2nd magnetic layer wherein between two adjacent 2nd magnetic layers, the Cr content and sum total content of non-magnetic elements are respectively larger for the 2nd magnetic layer disposed closer to the substrate.

28. Regarding these limitations, it is noted that Matsuda teaches that instead of forming 2 separate magnetic layers, wherein the 1st magnetic layer is a CoCrPt alloy and the 2nd magnetic layer is a CoCrPtB alloy, a magnetic layer having a composition gradient through its thickness can instead be utilized. When the gradient magnetic layer is utilized, the portion of the layer adjacent the underlayer has a composition approximating a CoCrPt alloy, and the portion of the magnetic layer farthest from the underlayer is a CoCrPtB alloy, and the composition of the layer varies continuously from the underlayer side to the surface layer side of the magnetic layer. This gradient magnetic layer exhibits fewer lattice defects and thus reduces the medium noise (column 5, lines 25-37). Matsuda teaches that a suitable CoCrPt alloy for the lower magnetic layer is a CoCrPt alloy containing 20-24 atomic % Cr, and 8-20 atomic % Pt.

29. Further, Paik teaches the impact of the concentration of Cr, Pt and B on the coercivity of CoCrPtB alloys, and teaches that a CoCrPtB alloy containing 10 atomic % Cr, 10 atomic % Pt, and 10 atomic % B exhibits a high coercivity of ~3000 kOe (page 3085, figure 2).

30. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made, to form the gradient magnetic layer taught by Matsuda as modified by Malhotra and Bian such that the portion of the gradient magnetic layer closest to the substrate is a $CoCr_{24}Pt_{20}$ alloy, and a the portion of the gradient magnetic layer farthest from the substrate is formed from the $CoCr_{10}Pt_{10}B_{10}$ alloy taught by Paik et al, wherein the magnetic layer exhibits a compositional gradient between the $CoCr_{24}Pt_{20}$ portion to the $CoCr_{10}Pt_{10}B_{10}$ portion.

31. One would have been motivated to make this modification in light of the fact that Matsuda is particularly concerned with the medium exhibiting a high coercivity between 2.2-3.5 kOe, as stated at column 5, lines 8-10 of Matsuda. Given this fact, one would have been motivated to form the portion of the gradient magnetic layer closest to the substrate with a $CoCr_{24}Pt_{20}$ alloy, because Matsuda specifically teaches that such an alloy will not prevent the desired coercivity from being obtained. One would have been specifically motivated to utilize the $CoCr_{10}Pt_{10}B_{10}$ alloy taught by Paik to form the portion of the gradient magnetic layer furthers from the substrate in light of the fact that Matsuda desires the medium to exhibit a coercivity of 2.2-3.0 kOe, and the $CoCr_{10}Pt_{10}B_{10}$ alloy of Paik is specifically taught to exhibit this coercivity. One would have been motivated to form the composition gradient between the $CoCr_{24}Pt_{20}$ portion of the gradient magnetic layer and the $CoCr_{10}Pt_{10}B_{10}$ portion of the gradient magnetic layer in light of the fact that Matsuda teaches that a gradient magnetic layer exhibits fewer crystal defects, and thus has lower noise.

32. It is the examiners position that when a gradient isolation layer having a $CoCr_{24}Pt_{20}$ alloy as the lowermost portion and a $CoCr_{10}Pt_{10}B_{10}$ alloy as the uppermost portion is formed, the limitations of claim 7 is met. This is due to the fact that when a gradient between these two alloys is formed, Cr and Pt decrease as the gradient progresses from the $CoCr_{24}Pt_{20}$ portion to the $CoCr_{10}Pt_{10}B_{10}$ portion, whereas B increases with thickness in this direction. Thus, the portion of the gradient closest to the $CoCr_{24}Pt_{20}$ portion will have less Cr and non-magnetic elements other then Cr which have an atomic radius greater than Co, and as the gradient layer progresses, the layers

closer to the $CoCr_{24}Pt_{20}$ portion will have a greater sum total of non-magnetic elements and Cr content then that of the layers closer to the $CoCr_{10}Pt_{10}B_{10}$ portion.

33. The limitations of claim 15 are essentially the same as claim 7 aside from the requirement of a generic method for forming the required layers. Thus, claim 15 is met as set forth above for claim 7.

Response to Arguments

34. Applicant's arguments filed 05/24/2004 have been fully considered but they are not persuasive. The applicant's arguments with respect to the previous 35 U.S.C. 102 rejections are moot, as these rejections have been withdrawn. Regarding the rejection of the instant claims as obvious under 35 U.S.C. 103(a) the applicant first argues that there is no motivation to one of ordinary skill in the art to modify the teachings of Matsuda, which uses one underlayer, to insert the dual underlayer taught by both Malhotra and Bian.

35. The examiner respectfully disagrees. Malhotra clearly establishes that magnetic media having dual CrTi underlayers exhibit improved signal amplitude (column 1, lines 50-53). Thus, there is explicit motivation in the prior art to modify Matsuda in the manner suggested.

36. Next, the applicant argues that Bian teaches away from the instantly claimed invention in view of the statement in Bian that the optimum lattice parameter spacing between the magnetic layer and the underlayer is not necessarily achieved at the higher Ti concentrations that are preferred for the seedlayer. Applicant argues that this

statement means that Bian teaches that the second underlayer should have less Ti than the seedlayer.

37. The examiner respectfully disagrees with the applicant's interpretation of the aforementioned statement. Bian teaches a specific example utilizing a $Cr_{93}Ti_7$ seedlayer and a $Cr_{90}Ti_{10}$ underlayer in table 2 (see column 3, line 21 and column 3, line 45). Further, examples utilizing seedlayers and underlayers having this composition exhibit improved signal to noise ratio over that of a magnetic medium utilizing a pure Cr seedlayer. This is clear evidence that the aforementioned statement in Bian does not teach away from the use of a seedlayer containing less Ti than the underlayer. Further, given this teaching and the teaching in Malhotra that the use of a dual CrTi underlayer can improve signal amplitude, one of ordinary skill in the art at the time the invention was made would have been motivated to utilize the $Cr93Ti_7$ seedlayer and $Cr_{90}Ti_{10}$ underlayer of Bian as the lower underlayer and upper underlayer (respectfully) taught by Matsuda as modified by Malhotra. Also, given the teaching in Bian that media utilizing this type of seedlayer/underlayer combination exhibit improved signal to noise ratio, one of ordinary skill in the art at the time the invention was made would have had a reasonable expectation of success in making the proposed modification.

38. Applicant's remaining arguments are unpersuasive in view of the above.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nikolas J. Uhlir whose telephone number is 571-272-1517. The examiner can normally be reached on Mon-Fri 7:30 am - 5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul J. Thibodeau can be reached on 571-272-1516. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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